[COMMITTEE PRINT]

HEALTH INFORMATION SYSTEMS

REPORT

PREPARED BY THE

CONGRESSIONAL RESEARCH SERVICE
LIBRARY OF CONGRESS

FOR THE

SUBCOMMITTEE ON
SCIENCE, RESEARCH AND TECHNOLOGY

AND THE

SUBCOMMITTEE ON NATURAL RESOURCES,
AGRICULTURE RESEARCH AND ENVIRONMENT

TRANSMITTED TO THE

COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
NINETY-SEVENTH CONGRESS

SECOND SESSION

Serial II

DECEMBER 1982

Printed for the use of the Committee on Science and Technology

---

U.S. GOVERNMENT PRINTING OFFICE
12-973 O WASHINGTON : 1983

H702-2

COMMITTEE ON SCIENCE AND TECHNOLOGY

DON FUQUA, Florida, *Chairman*

ROBERT A. ROE, New Jersey
GEORGE E. BROWN, Jr., California
JAMES H. SCHEUER, New York
RICHARD L. OTTINGER, New York
TOM HARKIN, Iowa
MARILYN LLOYD BOUQUARD, Tennessee
JAMES J. BLANCHARD, Michigan
TIMOTHY E. WIRTH, Colorado*
DOUG WALGREN, Pennsylvania
RONNIE G. FLIPPO, Alabama
DAN GLICKMAN, Kansas
ALBERT GORE, Jr., Tennessee
HAROLD L. VOLMER, Missouri
RICHARD C. WHITE, Texas
HAROLD L. VOLKMER, Missouri
HOWARD WOLPE, Michigan
BILL NELSON, Florida
STANLEY N. LUNDINE, New York
ALLEN E. ERTEL, Pennsylvania
BOB SHAMANSKY, Ohio
RALPH M. HALL, Texas
DAVE McCURDY, Oklahoma
MERVYN M. DYMALLY, California

LARRY WINN, Jr., Kansas
BARRY M. GOLDWATER, Jr., California
HAMILTON FISH, Jr., New York
MANUEL LUJAN, New Mexico
HAROLD C. HOLLENBECK, New Jersey
ROBERT S. WALKER, Pennsylvania
EDWIN B. FORSYTHE, New Jersey
WILLIAM CARNEY, New York
MARGARET M. HECKLER, Massachusetts
F. JAMES SENSENBRENNER, Jr., Wisconsin
VIN WEBER, Minnesota
JUDD GREGG, New Hampshire
RAYMOND J. McGRATH, New York
JOE SKEEN, New Mexico
CLAUDINE SCHNEIDER, Rhode Island
JIM DUNN, Michigan
BILL LOWERY, California

ROBERT C. KETCHAM, *General Counsel*
REGINA A. DAVIS, *Administrator*
DAVID S. JEFFERY, *Minority Staff Director*

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

DOUG WALGREN, Pennsylvania, *Chairman*

GEORGE E. BROWN, Jr., California
BOB SHAMANSKY, Ohio
MERVYN M. DYMALLY, California
STANLEY N. LUNDINE, New York
ALLEN E. ERTEL, Pennsylvania
RALPH M. HALL, Texas
DAVE McCURDY, Oklahoma

MARGARET M. HECKLER, Massachusetts
VIN WEBER, Minnesota
JUDD GREGG, New Hampshire
JOE SKEEN, New Mexico
EDWIN B. FORSYTHE, New Jersey

SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT

JAMES H. SCHEUER, New York, *Chairman*

GEORGE E. BROWN, Jr., California
JAMES J. BLANCHARD, Michigan
DOUG WALGREN, Pennsylvania
RICHARD C. WHITE, Texas

WILLIAM CARNEY, New York
F. JAMES SENSENBRENNER, Jr., Wisconsin
CLAUDINE SCHNEIDER, Rhode Island

---

*On assignment to Budget Committee for 97th Congress.

LETTER OF TRANSMITTAL

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, D.C.

Hon. DON FUQUA,
Chairman, Committee on Science and Technology, U.S. House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: We are transmitting herewith a report, "Health Information Systems," prepared by the Congressional Research Service at the request of the Subcommittee on Natural Resources, Agriculture Research, and Environment and the Subcommittee on Science, Research and Technology.

The Subcommittees requested an analysis by CRS of their joint hearings held in June, 1981 on Coordinated Health Information Systems. The transmitted report includes recommendations of the Subcommittees based on the CRS hearing analysis which comprises the second part of this report.

The hearing stressed the importance of coordinated health information systems in improving the quality of health care and the efficiency of health care planning and delivery within the United States. The need for a public forum or government focus to coordinate public and private sector objectives, needs and capabilities to facilitate the development, demonstration and implementation of improved health information systems was also emphasized.

We commend this report to your attention, to the attention of the Members of the Committee on Science and Technology, and the Members of the House of Representatives.

Sincerely yours,

JAMES H. SCHEUER, *Chairman,*
Subcommittee on Natural Resources,
Agriculture Research, and Environment.

DOUG WALGREN, *Chairman,*
Subcommittee on Science,
Research and Technology.

LETTER OF SUBMITTAL

CONGRESSIONAL RESEARCH SERVICE,
THE LIBRARY OF CONGRESS,
August 7, 1981.

Hon. JAMES SCHEUER,
Chairman, Subcommittee on Natural Resources, Agriculture Research, and Environment, Committee on Science and Technology, House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: I am pleased to submit this report entitled "Summary and Analysis of Hearings on a Coordinated Health Information System", prepared at the request of the Subcommittee on Science, Research and Technology and the Subcommittee on Natural Resources, Agriculture Research and Environment.

This report provides an analysis of the major issues discussed at the subcommittees' hearings on the need for, benefit of, and approaches to a coordinated health information system and outlines various proposals by witnesses for improving automated health information systems. Included is a description of current and potential uses of computer technology for improving the delivery of health care, identification of essential elements in designing health information systems, discussion of problems with existing health data collection activities and those associated with implementing a coordinated health information system. Possible approaches to establishing such a system, along with a case study of a recently developed environmental health information system, conclude the report.

The report was prepared by Jane Bortnick, Specialist in Information Science and Technology, and Kenneth Bogen, Analyst in Life Sciences, Science Policy Research Division.

We hope that this report will serve the needs of your committee and appreciate the opportunity to perform this challenging assignment.

Sincerely,

GILBERT GUDE, *Director.*

LETTER OF REQUEST

COMMITTEE ON SCIENCE AND TECHNOLOGY,
U.S. HOUSE OF REPRESENTATIVES,
Washington, D.C., May 14, 1981.

DR. JAMES MCCULLOUGH,
Chief, Science Policy Research Division, Congressional Research Service, Library of Congress, Washington, D.C.

DEAR DR. MCCULLOUGH: The Science, Research and Technology Subcommittee will be holding joint hearings with the Subcommittee on Natural Resources, Agriculture Research, and Environment on June 2, 3, and 4 on, "A Coordinated Health Information System." A brief description of the purpose of the hearing and background materials is attached.

We would be grateful if CRS could arrange to cover the hearings and assist in writing the Committee Report.

Dr. Sid Katz will be glad to provide any further information and can be reached at 225–6161.

Sincerely,

JAMES H. SCHEUER,
Chairman, Subcommittee on Natural Resources, Agriculture Research, and Environment.

DOUG WALGREN,
Chairman, Subcommittee on Science, Research and Technology.

Attachment.

CONTENTS

	Page
Letter of transmittal	III
Letter of submittal	V
Letter of request	VII
Recommendations of the Subcommittee on Natural Resources, Agriculture Research, and Environment and the Subcommittee on Science, Research and Technology	1

INTRODUCTION

I. Background	3
II. Legislative history	3
III. 1981 hearings	4
IV. Major points developed in hearings	5

SUMMARY AND ANALYSIS OF HEARINGS

I. Utility of health information systems	7
A. Types of systems	7
B. Existing uses of health information systems	9
C. Potential uses of health information systems	10
II. Elements necessary for a useful CHIS	11
A. Key data	11
B. Key linkages	12
C. Participation of key groups	12
III. Problems of existing health data collection activities	13
A. Lack of coordination	13
B. Lack of high level attention	13
C. Quality of data	14
D. Standards	14
IV. Problems associated with implementing a CHIS	15
A. Resistance from health professionals	15
B. Cost-benefit of a CHIS	16
C. Privacy concerns	17
D. Differing mandates and potential users	17
V. Possible approaches to a CHIS	18
A. Case study: Environmental health data	18
1. Review of existing data collection systems	19
2. Assessment of data needs	19
3. Conclusions and recommendations	19
B. Legislative oversight	20
C. Government sponsorship of programs	20
D. Interaction between public and private sectors	21

12-973 O - 83 - 2

Recommendations of the Subcommittee on Natural Resources, Agriculture Research, and Environment and of the Subcommittee on Science, Research and Technology

The application of information technology to health care has long been recognized as an effective means of improving health care planning, management and delivery. Recent rapid developments in inexpensive and versatile information technology has provided opportunities for application beyond those conceivable just a few years ago. Coordinated health information systems, ranging from medical education to national health statistics, are a key component to realizing the potential benefits of this technology for improving disease prevention and health promotion for the U.S. population.

Although legislative mandates have attempted to coordinate health services research, evaluation, demonstration, and health statistics activities, this identified need has received inadequate high-level attention by government officials and other providers and users of health care services and statistics. The development and integration of the various components of coordinated health information systems requires the active participation of both the public and private sectors. An identifiable public forum or government focus to develop, demonstrate, and implement a strategic plan for defining and coordinating essential health information systems does not currently exist. Therefore, the subcommittees recommend that:

The Office of Science and Technology Policy utilize the Federal Coordinating Council on Science, Engineering, and Technology to establish a forum for coordinating government, academic and industry objectives, needs and capabilities in moving toward more effective health information systems, identifying related national policy issues, and developing a strategic plan for designing and implementing improved systems.

INTRODUCTION

I. BACKGROUND

The merging of computer and telecommunications technologies offer the potential for increased efficiency in gathering, storing, analyzing, and disseminating information. In the field of health care modern information technologies can be applied across a wide array of activities ranging from health planning to patient diagnosis to hospital management. For example, the ability to synthesize data from patient histories may be used to improve long range planning for health care facilities, to perform epidemiological research, or to improve diagnostic capabilities.

One of the major stumbling blocks to the full utilization of both the information and the technology is the lack of coordination among various groups. Systems are often incompatible due to technical differences and often fail to satisfy the needs of the full range of potential users. At the same time, there are substantial problems associated with the large number of players involved in health information systems. In the Federal Government alone there are six cabinet level departments and a variety of independent agencies involved in health statistics collection. In total, there are 626 planned or operative individual health statistics projects. While there have been efforts to increase coordination of health data in recent years, the projects often remain overlapping in coverage.

The effective use of information technology constitutes a means for improving the health data collection process, reducing redundancy, and enhancing the ability to retrieve needed information. Despite the initial investments required, computers and telecommunications may provide long range savings for health care services. In addition, information technology offers the potential for improved health care and delivery of services by increasing access to current medical data for physicians and other health professionals.

II. LEGISLATIVE HISTORY

The current investigation of the Subcommittees on Science, Research and Technology and Natural Resources, Agriculture Research, and Environment of the House Committee on Science and Technology into coordinated health information systems builds on earlier efforts by the Committee in the 95th Congress to address the impact of the information revolution in the field of health care as well as other sectors. The 1978 hearings, "Computers in Health Care," found that a broad range of application areas existed, but that no overall national policy guided related efforts in the public or private sectors. Since 1978 a number of factors have changed. Rapid advances have been made in data processing and telecommunications techniques and additional legislation mandating health data collection activities has taken effect.

Among the major legislative attempts to mandate coordination efforts were Public Law 93–353 and Public Law 95–623. Public Law 93–353 provided a specific charter for the National Center for Health Statistics, which is the only Federal agency whose sole purpose is to collect and disseminate health data. This law also established the National Center for Health Services Research, which coordinates with the Health Care Finance Administration on the National Medical Care Expenditure Survey.

Public Law 93–353 placed additional coordination functions in the National Committee of Vital and Health Statistics. The Committee's mandate includes the responsibility "to determine, approve, revise the terms, definitions, classifications, and guidelines for assessing health status and health services. . . ." The Committee acts as an advisory group to the Secretary of Health and Human Services, who retains the authority to "coordinate all health services research, evaluation, demonstration, and health statistical activities."

Public Law 95–623 established an additional coordinating agency, the National Center for Health Care Technology, and provided statutory authority for the Cooperative Health Statistics System (CHSS). CHSS works to develop uniform data sets for State, Federal, and local use. In the long term, it is designed to provide a framework for a wide array of health data components. CHSS also conducts technical training sessions for health department personnel on the State and local levels and provides ongoing technical assistance to localities on data gathering and analysis.

III. 1981 HEARINGS

Three days of hearings were held on June 2, 3, and 4, 1981, to explore the potential of computer and telecommunications technology for improving health care and to review executive branch efforts in this area. The hearings focused on the issue of improving coordination between various health data collection activities and developing linkages between a variety of health information systems. The hearings also hoped to identify potential planning and research mechanisms for carrying out these essential activities.

Witnesses for the June 2 hearing were:

Joyce C. Lashof, M.D., Assistant Director, Health Sciences Division, Office of Technology Assessment;

Marion Ball, Ph. D. Director, Computer Systems, Temple University Health Science Center;

Stanley J. Matek, President-elect, American Public Health Association; and

E.R. Gabrieli, M.D., Editor-in-Chief, Journal of Clinical Computing.

Appearing on June 3 were:

Joanne Quan, Director, Data Systems, Health Systems Management, State of New York;

Byron Stuckey, Vice President, Technicon Information Systems; and

Allen J. Manzano, Senior Vice President, American Hospital Association.

June 4 witnesses were:

Erica Drazen, Manager, Health Care Unit, Arthur D. Little, Inc.;

Sidney Siegel, M.D., Administrator, Chemical Substances Information Network, U.S. Environmental Protection Agency;

John W. McGinnis, Tri-Service Medical Information Systems Program Office, Department of Defense;

Karen Duncan, Ph. D., Consultant, Hospital Information Systems; and

Edward N. Brandt, Jr., M.D., Ph. D., Assistant Secretary for Health, U.S. Department of Health and Human Services.

IV. MAJOR POINTS DEVELOPED IN HEARINGS

The hearings provided a forum for a number of perspectives to be presented on this topic. While general agreement existed that modern information technology is an important tool for enhancing health care delivery and optimizing resources, a number of different opinions were presented on how best to realize that potential. Among the major findings were:

1. Automated health information systems are being used in a number of areas including medical education, diagnosis and treatment evaluation, epidemiological research, health planning, and hospital management.

2. Most health information systems in use today are in the area of hospital administration or financial management. Only 30 hospitals have what might be labeled "comprehensive" medical information systems.

3. Current health information collection activities are hampered by lack of coordination, few standardized procedures, and poor quality of data.

4. To date, there has been little high level attention to developing coordinated health information systems by either government officials or medical professionals.

5. Several witnesses expressed skepticism about attempting to create any broad-based, national health data system. Many stressed that improved compatibility between distributed data bases might prove most valuable for a wide range of end users.

6. Standards for data sets gathered by different Federal, State, and local agencies, individual hospitals and doctors, and private enterprises could provide improved coordination and accessibility to health information.

7. Coordination efforts would be facilitated by the participation of a number of groups, including doctors, hospital administrators, drug manufacturers, Federal and State officials, professional associations, and systems-designers.

8. Adequate cost/benefit analyses and other statistical studies need to be performed to demonstrate the value of automated health information systems.

9. Overcoming resistance by health care professionals to computerized health information systems may require concrete demonstrations of benefits and increased training.

10. Improved coordination between the public and private sectors is a key element in successful implementation of coordinated health information systems.

Summary and Analysis of Hearings on a Coordinated Health Information System (CHIS)

I. UTILITY OF HEALTH INFORMATION SYSTEMS

Witnesses detailed many current and potential uses of health information systems. Generally the term "health information system" (HIS) was used to convey the idea of a formal organization of the concepts, methods, manpower, data processing and communications equipment, and other resources for acquiring and processing data bearing on health-related problems. The hearings focused on the feasibility and desirability of coordinated health information systems (CHIS), which would involve linkages of many individual health information systems operating at local, State, regional, and/or Federal levels. These individual systems would be of several types and would have a variety of current and potential specialized uses to be coordinated and thereby enhanced within the framework of a CHIS.

A. Types of systems

Individual health-related automated information systems from which a CHIS might be created fall into two broad categories: (1) systems designed to improve clinical diagnosis, treatment, and related research and educational activities directed at individual and public health care and (2) systems designed to improve hospital information management and health care finance and administration. Systems of the first type were referred to as "knowledge-based" systems, whereas systems of the second type were generally referred to as "hospital information systems" or "health care management systems."

Several witnesses described recent advances in knowledge-based medical information systems designed to aid practicing physicians and medical researchers. References were made to a number of prototypical and active information systems that have been developed, such as MEDLARS, CARDIOLOGIST, CADUCEUS, MYCIN, HEPATITIS, HELP, CARDIO-PRAKTICE, ARAMIS, AND SUMAC. These and similar systems were described as being real-time, online, "instant" data retrieval and analysis systems. These systems are currently available or under development by private and government entities to assist medical and public health practitioners to cope with and make use of the vast and expanding amount of relevant technical information. As described by one witness: (p. 272)*

> **A computer-based information system could alter the traditional memorizing of all medical knowledge. The computer could retrieve the trivial facts needed for a clinical decision such as the success rate for particular operations or the list of ranked antibiotics for the treatment of a particular microbial infection. This concept leads to a man-machine partnership where the human memory is assisted by the machine.**

*All page numbers refer to the published hearing record: U.S. Congress. House. Committee on Science and Technology. Subcommittee on Science, Research, and Technology and Subcommittee on Natural Resources, Agriculture Research and Environment. Health Information Systems. Hearings, 97th Cong., 1st Sess. June 2, 3, 4 and July 23, 1981. Washington, U.S. Government Printing Office, 1981. 580 p.

Witnesses described several examples of the second, hospital administration-/financial management-type systems. Technicon Medical Information Systems (TMIS) was cited as an example of one of the well established and more comprehensive systems available today. TMIS has been operational since 1972 at the El Camino Hospital in Mountain View, California, using dispersed computer terminals with video display screens and light pens, a high speed printer, and a central computer. It was noted during testimony that this and similar systems can now provide convenient, cost-effective, and timely access to patient medical and financial records for nurses, doctors, and hospital administrators, minimizing both paperwork and unnecessary delays involved in patient treatment. Dr. Marion Ball of the Temple University Health Science Center stated that, in her experience, hospitals employing automated management systems "can treat more patients and better without adding more staff, more nurses, more admissions officer, et cetera, and more people in the laboratories." (p. 99)

According to witnesses, about 600 computerized systems like those described above have been installed in the Nation's hospitals, which number approximately 7000, and in related organizations. Only about 100 of these systems fully employ state-of-the-art technological capabilities (referred to as "second generation, level two" systems), and only about 30 of these more advanced systems were characterized by witnesses as "comprehensive medical information systems" in use by U.S. hospitals.

Another major type of health information system discussed during the hearings, concerns health-related data collected by Federal agencies in fulfilling their statutory mandates. For example, a recent review by the National Center for Health Statistics (NCHS) of data collection systems bearing on human health, pollution, and related medical, occupational, and environmental factors was cited during the hearings.[1] A number of these systems would be incorporated, most likely, into a CHIS along with individual health care finance systems, hospital administration systems, and medical knowledge-base systems. The review identified 64 major data collection systems in 18 Federal agencies. These systems provide such Federal data sets as NCHS's Basic Vital Statistics, the Bureau of Labor Statistics' Annual Occupational Injuries and Illness Survey, and the Health Care Finance Administration's Medicare Claims File.

Several descriptions were presented during the hearings of large-scale, integrated health information systems currently in use or in the development phase which may be considered to be prototype or partial models of systems which may be incorporated into a CHIS. One of these was the New York Statewide Planning and Research Cooperative System (SPARCS), which stores and processes a variety of in-patient medical, demographic, and cost accounting data from all New York State hospitals for retrospective review and Federal reporting purposes. The SPARCS system is one of eight such systems under development since 1978 through the Health Care Finance Administration's Integrated Data Demonstration Systems project. Other

[1] National Center for Health Statistics. Environmental Health : A Plan for Collecting and Coordinating Statistical and Epidemiological Data. Washington, U.S. Dept. of Health and Human Services, 1980. 78 p. (PHS–80–1248)

"semi-comprehensive" systems under development that were described during the hearings include: the Chemical Substances Information Network (CSIN), under the direction of the Environmental Protection Agency (EPA) with the assistance of the Council on Environmental Quality (CEQ); the Defense Department's Tri-Service Medical Information System (TRIMIS); CEQ's UPGRADE system, which provides integrated environmental health and census data obtained from four Federal agencies; and EPA's POPATRISK system, which provides integrated environmental and health data obtained from three Federal agencies. Both the CSIN and the TRIMIS systems were cited by witnesses as being likely to parallel the development of a CHIS in terms of implementation problems and considerations, for example, in the areas of technology development; administrative and legal relationships with owners or managers of independent resources; confidentiality and the appropriate sharing of data; data rights; copyrights; data quality; and use of mathematical modeling or correlation techniques in a network environment.

There was some degree of confusion conveyed by the witnesses regarding the exact nature of the CHIS concept under discussion. Several witnesses emphasized that the concept of a "coordinated health information system" is complicated by the fact that the types of automated health information systems discussed above can be used for a variety of purposes (summarized below). Others noted that coordination among systems designed to achieve any of these purposes is possible at local, State, regional, Federal, or national levels and could be approached either centrally or through a distributed network. No consensus emerged regarding the specification of optimal goals and levels of coordination to be achieved by means of the proposed CHIS. For example, a witness suggested that one "think of a comprehensive health information system as a concept, as something that provides a policy framework for information flow in the health care delivery system." (p. 457) Other witnesses provided examples of how a system could be created through linking a variety of resources. Dr. Sidney Siegel, in his description of the Chemical Substances Information Network (CSIN) stated that they found: (p. 421)

> . . . The best method of providing the large volumes of diverse and disparate data and information needed by a broad spectrum of user communities (each with unique requirements) was to blend two technologies . . . networking and distributed data base management. . . .

B. Existing uses of health information systems

A variety of current uses for health information systems were described by witnesses during the hearings. One document submitted for the record summarized, as follows, the general uses of current systems collecting and analyzing health information: [2]

> The purpose of health (or medical) information is: to identify individual and collective health problems; to assess their relative severity and urgency; to estimate their prevalence and social costs; to identify and assess the relative safety, risks, and efficacy of various forms of intervention; and to evaluate the benefits, costs, and effectiveness of measures advocated for the prevention, control, or amelioration of individual and community health problems. In short, health information, as distinguished from medical information, is concerned with the enhancement of levels of individual and collective health to which present and future populations may aspire.

[2] White, Kerr L. Information for Health Care: An Epidemiological Perspective. Inquiry. v. 17, Winter 1980: 296–312.

The knowledge-based, instant retrieval type of systems were noted for their increasing ability to access increasingly broad spectra of information. In the area of research, these systems have been used to facilitate the analysis of laboratory and field data, to aid the development of pharmacological products and medical devices, and to enhance epidemiological and toxicological research capabilities. Initial progress was reported by witnesses in the area of clinical applications, where health information systems are beginning to be used to aid patient care. Among these applications are: prospective (that is, bedside) and retrospective patient diagnosis (for example, by means of accessing relevant medical literature), as a source of suggestions for possible therapeutic treatments, for advising physicians of potential conflicts arising from selected treatment regimens, for speeding up the reporting of clinical laboratory results, and for monitoring patient condition and progress.

Hospital administration/financial management types of health information systems, according to witnesses, currently are being used to streamline and cut the costs of health care by coordinating the flow of information in hospitals relating to patient admission, discharge, transfer, order reporting (for example, with respect to pharmaceuticals or X-rays), and billing. Several witnesses referred to economic studies demonstrating the cost-effectiveness of certain systems, such as elements of the TRIMIS system and the TMIS system in use at El Camino Hospital in California. Colonel McGinnis of the TRIMIS program provided an example of the cost-effectiveness of its computerized pharmacy system. He stated that the system would be considered cost-beneficial at a rate of 26.3 cents per prescription and that currently its costs are validated at 12 cents per prescription. (p. 447)

Additional uses of health information systems are made by Federal agencies in order to implement the multiple and often disparate requirements of the more than 160 separate statutory authorities that directly or indirectly specify actions resulting in health-related data collection. Office of Technology Assessment (OTA) staff reviewed some of these Federal efforts during the hearings, and referred to the following OTA reports bearing on health information systems: "Policy Implications of Medical Information Systems" (1977), "Computer Technology in Medical Education and Assessment" (1979), "Selected Topics in Federal Health Statistics" (1979), and "Technologies for Determining Cancer Risks from the Environment" (1981).

C. Potential uses of health information systems

Most witnesses were enthusiastic in their commentary regarding the potential applications of health information systems and, in particular, some type of CHIS. In addition to enhancing and broadening the accessibility of current HIS uses, witnesses suggested possible future uses in the areas of health and medical education (allowing medical curriculum revision and facilitating continuing medical education requirements); new areas of patient diagnosis and medical research; health care quality assurance (for example, surveillance of hospital performance); financial studies for cost containment and for increased efficiency and equity in insurance rate setting; epidemiological and public health research and policy analysis; assessing the value of new drugs and medical technologies; monitoring the impact of environmental and workplace hazards; monitoring and assessment of Federal resource

allocations for public health and health care programs; and long-range planning and policy formation.

Specific examples provided by witnesses included the ability of physicians "to analyze his own practice, his own diagnostic accuracy and his own success treating certain disease categories"; of patients to have "instant availability of a blood group or a recent electrocardiogram . . . in certain emergencies"; of planners to have "access to current and accurate statistical data"; and of drug manufacturers to "be able to study the indications, effectiveness and adverse reactions of their products as perceived by the practitioners." (p. 274–276)

Most witnesses also agreed that the attainment of these goals is (1) currently hindered by the multiplicity of Federal and private sector data collection and data filing systems and their attendant institutional barriers and (2) would be facilitated by improved coordination between public and private sectors toward the establishment of a CHIS.

II. ELEMENTS NECESSARY FOR A USEFUL CHIS

Witnesses highlighted several critical elements that would be essential to the development, organization, and operation of a large-scale health information system coordinated at the Federal or regional level. Types of critical elements identified included basic data, component HIS linkages, and the participation of key groups of people.

A. Key data

Several witnesses emphasized the importance of structuring the goals and user priorities of the proposed CHIS prior to the design and implementation of the system. These goals, based on current and anticipated user needs, would then guide the selection of essential data to serve as input into the CHIS information network as well as the selection of the most useful "architectural" design of the CHIS data processing capability. Identifying user needs was considered the most important factor in designing a health information system. Ms. Erica Drazen stated that: (p. 402)

> If the system is not needed, if it doesn't offer users tangible benefits which they can see and value, potential users will not be motivated to learn to use a new system, will be intolerant of inevitable start-up problems, and will almost always reject the system. Conversely, a system which meets a real need will almost always be used even if substantial user training and change in practice is required.

Depending on the CHIS goals selected, appropriate medical, environmental, demographic, epidemiological, financial, health care, and other health-related types of data would be chosen as CHIS inputs. Suggested sources for such data include government agencies, insurance companies, hospitals, clinics, health maintenance organizations (HMO), nursing homes, and other providers of medical care and public health services.

In addition to the selection of particular data to be included in a CHIS. witnesses focused on several general characteristics that would be advantageous for CHIS input data to have. Reasonable data uniformity was stressed as a necessity to useful data analysis. The "International Classification of Diseases" or guidelines issued by HHS's Health Data Advisory Committee might provide a standard.

Other references to desirable data characteristics included suggestions that the data should be: person-specific (that is, relate to involved or affected individuals, the targets of health care efforts); population-based (that is, distinguished between significant geopolitical areas); problem-oriented; provider-specific (that is, identify the sources of health care, the provision of which CHIS would monitor); health care procedure-specific (that is, identify types of care provided); and period-specific (that is, have the capacity to relate persons and places over periods of time).

B. Key linkages

Several witnesses commented on the nature and extent of linkages between component information systems that would be necessary to a useful CHIS. There was general agreement that the CHIS proposals considered would all involve some degree of coordination and linkage among Federal information systems, such as those maintained by the Social Security Administration, the Internal Revenue Service, the Veterans Administration, the Bureau of the Census, the National Center for Health Statistics, the Health Care Finance Administration, and the National Cancer Institute. An example of such an effort to link data from several agencies was offered by Dr. Joyce Lashof of the Office of Technology Assessment: (p. 9)

> Individuals in several government agencies have been promoting a Linked Administrative Statistical Sample (LASS), a pilot project designed to bring together records of the IRS, SSA, and NCHS. The project planners aim to provide an improved database for mortality research by compiling statistical information from the participating agencies on a sample of individuals.

Emphasis also was placed on the need for linking information systems operated at the State level with those operated at the Federal level, and for linking information systems recording clinical records with those recording other relevant information, such as health care finance data.

C. Participation of key groups

Throughout the hearings, witnesses stressed the importance of ensuring the participation in CHIS planning and development of interested and affected parties. The broad range of providers of health care and services would be critical participants in any planning effort. Several witnesses emphasized that, if a CHIS is to have clinical diagnostic applications, CHIS development must involve the practicing physicians and related allied health personnel who would be expected to use the system.

A number of witnesses also expressed the position that CHIS development would be facilitated significantly by the establishment of a strong advocacy body at the national level (for example, a CHIS Commission or Institute), which would include representatives of interested parties such as those mentioned above. As one witness noted, "potential public and private users of a CHIS need to be brought together to jointly develop a list of requirements that they believe should be met and to begin exploring the methods that may be used to meet these needs." (p. 340)

III. PROBLEMS OF EXISTING HEALTH DATA COLLECTION ACTIVITIES

A number of witnesses cited problems in combining existing automated information systems. As indicated in the previous section, a wide range of automated health information systems serving different constituencies currently are operating or are under development. It was noted, however, that these systems face common difficulties ranging from poor quality of data to lack of coordination. Several witnesses highlighted the need to improve existing data collection activities as an important step toward creation of a CHIS.

A. Lack of coordination

There was a consensus among witnesses that current efforts to gather health-related information are scattered among a number of interested parties, including the Federal and State Governments, health providers, medical institutions, and insurance companies. At present, little has been done to coordinate these numerous activities in order to avoid duplication of effort, reduce the costs associated with data collection, or improve the availability of health care information. Even within the Federal Government, there has been little attempt to systematize the different efforts to gather health data. For example, Dr. Lashof of the Office of Technology Assessment stated that: (p. 8)

> . . . our health data system has developed over the years as a result of multiple, often disparate requirements and . . . although the elements of a traditional health information system exist, coordination and linkages will be necessary before an effective information system becomes a reality.

The problem of coordination is compounded when one moves beyond government agencies into the myriad of private sector entities which collect, utilize, and disseminate medical data. Another aspect of this problem noted by several witnesses is the highly specialized nature of the health care system today. This results in isolated efforts to satisfy specific data requirements, rather than the creation of a broader perspective for developing large scale health information systems.

B. Lack of high level attention

Closely related to the lack of coordination among health data collection activities, according to some witnesses, is the little attention paid to these matters by those in positions of power in the medical field. While several witnesses targeted the Federal Government for its inattention to coordinating and developing health information systems, others testified that physicians and hospital administrators equally lack leadership in this area. As one witness noted, what is often needed to support a new effort at automating health information is "the existence of powerful, dedicated, advocates for the system within the facility or within the setting where it is being implemented." (p. 402) Dr. Lashof echoed the need for greater attention to health information systems at higher levels within the Federal Government. Specifically she commented: (p. 26)

> What has been lacking is one central body at the secretarial level looking at the totality of things collected and beginning to set better priorities as to how that money ought to be directed.

This view, however, was not shared by all the witnesses. Some preferred a decentralized, local approach to automating health information systems. These witnesses, primarily from the health care profes-

sions, expressed concern that a large-scale approach would be cumbersome, expensive, and fail to meet the needs of users. For example, in a letter submitted for the hearing record, the Blue Cross/Blue Shield Association stated that "Linking existing systems together is a more profitable and acceptable route to explore than imposing a national directive for a CHIS." (p. 557)

C. Quality of data

One area in which there was a consensus among witnesses concerned the need for improved quality of medical data. Witnesses repeatedly stated that current health information systems are plagued by a high rate of error. A number of reasons were cited for this problem, including such things as incorrect coding of data, poor systems design, difficulty of establishing appropriate coding schemes, and unwillingness of physicians to enter all critical information. Dr. E. R. Gabrielli stated that "our basic data are so bad that we cannot really create an accurate information system in this country until we insist on accuracy at the level of the physician and his record." (p. 265)

Modern technology provides an opportunity to improve the quality of data through such things as automated editing or error detection capabilities, but at the same time accentuates deviations and inconsistencies. As a result, witnesses noted that computerized health information systems may require special attention to validation of information and the institutition of new processes to ensure quality control.

D. Standards

The establishment of standards is a key element in the creation of valid databases and an issue which many witnesses considered of primary importance. At present, no common standards exist which cut across the range of existing health information systems— a fact which several witnesses stated is currently impeding coordination efforts. Standards may be required in a number of areas ranging from hardware, to software, to data entry formats, to descriptions of data. For example, Dr. Marion Ball stated: (p. 102)

> We have no standards with regard to major databases. We don't have at the moment the type of standards we would need in languages these various systems are being developed in. . . . The point that you have 300 . . . different types of bases, just with the Federal Government, for reporting various types of health care statistics is a tragedy if there is no vehicle or mechanism for these to be able to interact with each other and be linked.

Another major obstacle in establishing standards involves classification of such things as diseases and symptoms. As noted by one witness, "There is such a broad scope to the medical clinical information that I think one must take great care that each element is defined as an element . . . so that it can be standardized in format." (p. 349)

Some efforts at standardization already are underway. New York State has developed a Statewide Planning and Research Cooperative System (SPARCS) has been developed to gather and process data on patients from all hospitals in the State. One of the critical elements of this system is the design of SPARCS reporting forms which provide for uniform collection of patient data from all hospitals. The establishment of this uniform data set was mandated by the State based upon the belief that "without such a mandate hospitals would use their own sets of data elements with their own definitions." (p. 291)

The need for standards has been recognized at the Federal level as well. A number of representatives of Federal agencies who testified at the hearings reflected on their experiences in establishing computerized health information systems and the associated development of standardized procedures, formats, and definitions which might serve as prototypes for further work in this field. Among these efforts are the U.S. Environmental Protection Agency's Chemical Substances Information Network (CSIN), the Department of Defense's Tri-Service Medical Information Systems (TRIMIS) Program Office, and several activities of the Department of Health and Human Services for establishing minimum standards for patient utilization information. According to Colonel McGinnis of the TRIMIS program: (p. 450)

> We believe the standards which we are developing will allow commercially available systems to interact with our core, will be made available to the public at large and will help solve that problem of incompatibility of systems and will be in the public domain.

While the problem of standards remains a formidable one, it is being addressed by a number of key participants in the debate on coordinated health information systems and efforts are underway to establish workable standards on a number of levels.

IV. PROBLEMS ASSOCIATED WITH IMPLEMENTING A CHIS

Witnesses concurred in the need to improve existing health information systems through better coordination, increased attention at decisionmaking levels, better quality data, and more standardization. They also agreed that data processing and communications technologies offer new opportunities to improve health care planning and assist physicians in patient care. There was no consensus, however, concerning the specific approach which might be pursued for achieving these goals. In some instances, witnesses suggested a centralized effort stemming from the Federal Government. In others, emphasis was placed on State and local entities as the key movers in coordinating health information systems. Suggestions were made by some witnesses to utilize existing systems as the core of a CHIS by networking current databases and facilities. Other witnesses took the position that only a totally new approach would suffice in bringing about the full potential of computers and communications technologies in health care. In all cases, however, there was agreement that certain problems would have to be overcome to ensure the implementation of a CHIS. Among these problems which received repeated attention by witnesses were resistance within the health professions, high start-up costs, concerns for personal privacy, lack of adequate cost-benefit analyses, and differing needs of potential users of a CHIS.

A. Resistance from health professionals

Witnesses commented on the general resistance to the use of computerized information systems by many health professionals and in particular, physicians and hospital administrators. This resistance was blamed partially upon the normal reluctance to adopt new procedures, but also reflected certain skepticism about the utility of these systems and concern that automation would result in increased regulation and monitoring of health care activities. As stated by one witness: (p. 112)

Computer technology and telecommunications are not the problem. The real issue in addressing a coordinated Health Information System is overcoming resistance to telecommunication innovations in medical practice and administration.

Several witnesses noted that health professionals needed to be shown the advantages that coordinated health information systems can provide. For example, nurses tend to be more enthusiastic about the use of automated hospital information systems because they improve efficiency at the nursing stations and reduce burdensome paperwork. On the other hand, physicians and hospital administrators may be afraid that they have more to lose than gain from the employment of automated systems. As one witness stated, "one of the major fears is that computer technology will violate . . . physician confidentiality. They do not want somebody telling them they are doing the job incorrectly or inadequately." (p. 150) As a result, the suggestion was made by several witnesses that efforts be undertaken to demonstrate the utility of computerized health information systems to physicians and to increase training on computerized systems in medical schools. Thus, to ensure the success of a coordinated health information system, "these people have got to be won over; they have got to be brought into this process." (p. 458)

B. Cost-benefit of a CHIS

Closely linked to the problem of demonstrating the utility of a coordinated health information system to potential users is the issue of evaluating costs and benefits. Although there were differing opinions about the funding which might be required to initiate a CHIS, generally witnesses stated that, in the long term, computer technology could reduce administrative costs associated with data handling. Many of the benefits which might accrue from a CHIS, however, are difficult to quantify. For example, it is difficult to statistically measure the role that a CHIS might play in improved patient care.

Initial start-up costs for automated health information systems was one concern expressed by several witnesses. Despite the fact that computer and communications hardware continue to decline in cost, other things, such as software development and associated personnel, continue to rise. From the perspective of the Federal Government, the Assistant Secretary for Health of the Department of Health and Human Services, Dr. Edward Brandt, questioned "whether we would be pricing the gathering of pertinent data outside of our available resources." (p. 490) Speaking for the American Hospital Association, Mr. Al Manzano concurred in his statement that "its [CHIS] development, however, must be tempered by pragmatic concerns for the utility of its products and its physical and social costs." (p. 358)

Several witnesses who supported the CHIS concept provided examples, however, of the ultimate utility of automated health information systems. For example, Mr. Byron Stuckey of Technicon Medical Information Systems Corporation cited several studies which have shown that medical information systems "lowered the cost of the delivery of patient care within the hospital and . . . improved the quality of care delivered. . . ." (p. 351) Similarly, Dr. Ball of Temple University asserted that with computerization "it is possible for the physician to act more rapidly . . . and it gets him [the patient] out of the hospital faster. . . ." (p. 110)

The witnesses—despite their own perspective on a CHIS—all agreed that a great deal more needs to be done to provide definitive answers to the questions of costs and benefits of computerized information systems. The lack of unbiased, statistically sound cost-benefit analyses are seriously lacking at present and several witnesses suggested that these be undertaken on a priority basis before proceeding further with planning for a CHIS. One expert in planning health information systems highlighted the value of cost-benefit analysis for both setting priorities and for convincing health professionals of the value of a CHIS. Ms. Erica Drazen emphasized that "information on the actual costs and benefits of any information system application are sorely lacking. . . . Data on system impacts and system benefits are really not available." (p. 399) Several witnesses commented that the Federal Government might play an important role in providing support for such needed analyses.

C. Privacy concerns

The development of computerized record systems which combine large, centralized databases with remote access has highlighted the need for better controls and management of medical records. In recent years both the public and the private sectors have addressed the need to balance legitimate utilization of personal medical information with the protection of the individual from possible misuse. While the technology provides some special capabilities for aiding the protection of privacy—for example, encryption—it also poses an additional threat to the confidentiality of sensitive personal information contained in medical records.

The privacy problem is one issue which nearly all witnesses indicated required priority attention in the planning for any coordinated health information system. While some witnesses apparently were extremely pessimistic about the solution to this dilemma, others stated that adequate safeguards could be established to protect individual privacy. For example, the representative of the American Medical Association, stated: (p. 560)

> It is our view that no system yet developed can assure total security (as some of the nation's largest banks have learned), nor can sufficient controls ever be developed that can prevent the improper manipulation or use of data contained in the systems.

Despite general agreement that the privacy issue was a particularly difficult one which required substantial study, indications were offered by some witnesses that, with adequate planning and controls, workable solutions could be achieved. The New York SPARCS operation has established privacy regulations which are "the first set of specific confidentiality procedures in the country to govern hospital data systems." (p. 292) These regulations created a Data Protection Review Board which makes recommendations on the release of information which might identify an individual or institution. According to Ms. Joanne Quann, Deputy Director of New York's Office of Health Systems Management, this system "provides a uniform safeguard to protect individual privacy" and "these procedures should serve as a model for other states." (p. 293)

D. Differing mandates and potential users

To achieve a viable coordinated health information system may require coordinating numerous established requirements for data collec-

tion which are often disparate and inconsistent. In addition, the broad range of potential users will have individual needs for specific kinds of data which must be met. The larger the community of users, the greater the need to service more diverse information requirements.

Several witnesses commented on the potentially competing interests which will need to be harmonized when designing a CHIS. For example, practicing physicians may be primarily interested in data which can assist diagnosis; hospital administrators in data concerning inpatient services; health planners in demographic information; researchers in long term epidemiological data; and insurance companies in billing information. A major problem for designers of a CHIS is how to satisfy this differing array of potential users. As one witness stated: (p. 338)

> There are significant differences between systems developed to meet the public objective of operating a health facility efficiently and those designed to meet the public objective of obtaining data for determining how the nation's medical care should be delivered.

Federal and State Government agencies which are charged with implementing specific programs often face a similar dilemma. For example, Dr. Brandt of the Department of Health and Human Services emphasized that "it is important to realize that much of the data collection through Department systems is directly related to the program responsibilities within separate and unique agency functions." (p. 506)

It is for these reasons that witnesses underscored the importance of effective planning for coordinated health information systems and the critical role that can be played by potential system users in the development process. As was indicated earlier in this report, a wide variety of computerized information systems currently exist which may provide the foundation for a more expanded CHIS. The challenge to policymakers, as most witnesses suggested, is to link existing capabilities effectively and to provide stimulus for further development in areas where it is needed.

V. POSSIBLE APPROACHES TO A COORDINATED HEALTH INFORMATION SYSTEM (CHIS)

A. Case study: Environmental health data

A recently developed NCHS plan for collecting and coordinating statistical and epidemiological data relating to environmental health was submitted for the hearing record as an example of a possible approach to developing a CHIS.[3] The plan was developed in order to implement certain provisions of the Health Services Research, Health Statistics, and Health Care Technology Act of 1978 (P.L. 95–623, signed into law on November 8, 1979). These provisions require the Department of Health and Human Services to initiate efforts concerning the impact of pollutants and other environmental conditions on human health, including an on-going study of the causes and costs associated with environment-related disease; an examination of issues relating to the establishment of a Federal system to locate individuals exposed to hazardous substances and to ensure their access to appropriate medical care and treatment; and the collection, coordination, and

[3] National Center for Health Statistics, op. cit.

analysis of environmental health data preceded by the preparation of an appropriate plan and set of guidelines.

The plan prepared by NCHS includes three of the key elements that also might be applicable to the development of the more integrated and comprehensive health information system implied by the CHIS concept. These elements are briefly summarized below.

1. *Review of existing data collection systems.*—The NCHS plan reviewed the major existing environmental health data collection systems (as required by Public Law 95–623). A total of 64 major data collection systems were identified in 18 agencies throughout the federal executive branch and selected on the basis of their significance in terms of size, continuity, monitoring of exposures or diseases, and accessibility. The systems identified were categorized according to the following six major functions:

1. Measures Population Health Status;
2. Documents Medical Care Need or Use;
3. Tests Interrelationships Between Diseases and Suspected Causal Factors;
4. Records Environmental Inspections;
5. Measures Environmental Pollutants or Individual Exposures; and
6. Links Data on the Environment and Health.

The systems within the above categories then were described further in terms of certain characteristics. Among these were their specific purpose; topical focus of data on health and/or exposure of individuals or the environment; method of data collection; coverage with respect to population, location, and time; method of data dissemination; and type of statistics generated. An analysis also was made of the distribution within Federal agencies of data systems falling into the six categories listed above, as well as the topical range and potential limitations of the data collection systems reviewed.

2. *Assessment of data needs.*—The NCHS plan addressed needs for improvement in environmental health data bases that would generate the capability of providing better information for deciding related regulatory and resource allocation issues. Data deficiencies were assessed according to five criteria: availability, quality, accessibility, analysis capability, and utility (applicability to environmental health problems). Four major areas of data deficiency were identified:

1. Identification and measurement of environmental exposures,
2. Precision of correlation between health effects and specific environmental exposures,
3. Identification and tracking of populations useful for studying environmentally related disease, and
4. Estimation of costs of environmentally related disease.

Research directions to address these deficiencies were suggested, along with related policy considerations.

3. *Conclusions and recommendations.*—Three major recommendations were offered in the conclusion of the NCHS plan. First, it was recommended that each Federal agency charged with environmental responsibilities should undertake a review of its activities involving environmental health data. Second, increased interagency coordination in environmental health data activities was recommended, for example, through the coordinated application of the "minimum uniform data

set" concept utilizing standardized population and location identifiers. Finally, a recommendation was made for better surveillance of population health and exposure status, particularly through the encouragement of major surveillance and registry projects. These recommendations were accompanied by corresponding sets of more detailed suggestions.

Although the NCHS plan briefly summarized above focused on environmental health information systems development in particular, the plan is relevant to the development of a CHIS for two basic reasons. First, based on suggestions made by witnesses, environmental health information systems almost certainly would be a component of a CHIS. Second, the structure of the plan can be generalized easily to apply to a proposed coordinated network of health information systems, as opposed to solely environmental health information systems. Witnesses seemed to agree that the development of a CHIS also would benefit from a similar approach involving a thorough review of relevant data collection systems, assessment of health information needs, and analysis of strategic options and policy recommendations.

B. Legislative oversight

Several witnesses commented on the importance of legislative oversight of the development of computerized health information systems by executive branch agencies. It was noted that a substantial amount of Federal and State legislation exists which mandates the collection of health statistics for various purposes. There has been less attention, however, to ensuring that these disparate data collection activities are well coordinated to avoid duplication of effort and optimize the utility of the information. It was stated that no mechanisms exist, for example, to monitor health data collection activtities across the large number of involved Federal agencies.

During follow-up testimony Assistant Secretary for Health Brandt of the Department of Health and Human Services (HHS) indicated that more attention is being focused on the topic of data collection activities within the Department in response to the Committee's concerns. Dr. Brandt stated, however, that further work toward any coordinated health information system should be done cautiously on an incremental basis. He also noted that the Health Data Advisory Committee of HHS is becoming more active in such tasks as developing standardized definitions.

C. Government sponsorship of programs

A number of suggestions were made concerning constructive steps that the Federal Government might take in assisting the development of a coordinated health information system. These included such things as the establishment of standards; funding of pilot projects such as the one underway in New York State; providing support for training programs; creating financial incentives for utilizing computerized systems in hospitals; and undertaking cost-benefit analyses and other studies concerning the impact of computer technology on health care. Several witnesses emphasized the importance of disseminating information on the utility of automated health information systems, whether through organized campaigns, assessments of the technology, or individual projects.

Other witnesses highlighted the need for the Government to provide certain types of financial support. For example, certain "priming costs" are needed often to initiate new undertakings of this kind. Another type of financial incentive the Government might provide involves changing the cost reimbursement methodology for such things as Medicare. One witness noted that, under existing guidelines, "the disincentive with respect to information systems is that they [hospitals] are leery of the possibility that they might not be fully reimbursed [for] the cost of those systems." (p. 353)

D. Interaction between public and private sectors

General agreement existed among all witnesses that an effort to coordiate health information could not be accomplished by the Federal Government alone. Several witnesses apparently felt strongly that the lead should, in fact, be left to the private sector or State and local governments for developing new systems of this type. Although a specific organization for linking the public and private sectors was not agreed upon, there were strong recommendations that some kind of mechanisms be created which would enable both groups to work cooperatively toward utilizing modern technology in health care. As stated by one witness and echoed by others, "it has to be a public/private venture." (p. 461)

There were some specific recommendations concerning the form such cooperation should take. For example, while representatives of the American Hospital Association saw the utility of "a mechanism that would provide for sort of an oversight policymaking group" (p. 390), they also emphasized that "given this extensive private sector activity, we feel that the federal government's logical role would be one of filling gaps, where necessary, rather than one of being the controlling agency." (p. 360)

Other witnesses saw the need for some new entity, such as an independent institute, which could address the broad range of issues involved in developing a coordinated health information system. Dr. Karen Duncan stated that "clearly, an independent planning agency, in which all interests can be served is called for in my mind." (p. 461) Whatever the particular mechanism employed, it ultimately may require according to Dr. E. R. Gabrielli: (p. 266)

> . . . a completely new bold, imaginative approach where private sector and the government should become a partnership, remove all commitments of the past, [and] use the best brains of the country.

○